California Monthly Climate Summary
March 2011

Weather Highlights

March 2011 was a near record setter for California for precipitation and a near normal month for temperature. According to the Western Region Climate Center's California Climate Tracker, the monthly average temperature was 46.9°F which is 1.0°F lower than the long-term average of 47.9°F. With a statewide average of 6.41 inches, precipitation for March was 205% of the long term average.

March 2011 proved to be a wet and wild month. It started quietly enough with dry conditions for everywhere except the northwest part of the state. By the middle of the first week the month's first storm system rolled into northern California before continuing on into southern California by the end of the week. A second system followed on the heels of the first one heading into the start of the second week. Moderate snowfall occurred in high elevations and heavy rain was reported in coastal regions. Southern California reported gusty winds as high pressure started to build. By the middle of the second week inland temperatures soared into the 80s and low 90s. The warmth and dryness didn't last for long as a series of storms lined up for the third week of the month. These storms were wet but cold. Although snow levels were relatively low the persistent rains saturated the ground and led to localized flooding. Southern California evaded most of the storms until the final storm of the week when heavy rains and strong winds struck the region. The fourth week of the month offered no respite as more storm systems moved over the state. Thunderstorms accompanied these systems bringing hail and a few small tornados to the State. March 2011 exited quiet as a lamb with warm and dry conditions in place across the State.

Preliminary records, reported on the National Weather Service Record Event Report, show that statewide there were 56 temperature records tied or broken and 26 precipitation records tied or broken for the month. Of the 56 temperature records set, 38 were for new high maximum temperatures. Records were set over 15 days of the month. On March 5th, Eureka broke a 1912 daily record for precipitation with 1.39 inches. The old record was 1.32. Sacramento topped some precipitation marks from the miracle March of 1991 on the 24th. The executive airport site recorded 1.11 inches which broke the 1991 value of 0.92 inches. The downtown site also recorded 1.11 inches which topped the 1991 value of 1.06 inches. On March 20th southern California recorded some of its greatest rainfall totals for March. Santa Barbara airport recorded 5.23 inches for the day which topped the old record of 0.90 inches set in 1991. This is also more than the monthly record of 4.74 inches set on March 15th, 2003. Camarillo recorded 4.91 inches of rain which topped the 2.26 inches set back in 1954 and also beat out the monthly record of 4.60 inches set on March 8th, 1968. Palmdale also broke the daily and monthly records with 1.29 inches of rain. The previous daily record was 0.50 inches set in 1973 and the monthly record was 1.20 inches set on March 7th, 1952. Sandberg had its second wettest March day with 3.29 inches of rain and Los Angeles airport recorded its third wettest March day with 2.36 inches. Both

the Sandberg and Los Angeles daily marks are new daily records for March 20. On March 31st, Furnace Creek in Death Valley recorded a high temperature of 103°F setting the all time record high for March. The old record was 102°F set on March 28, 1986, March 21, 2004, March 16, 2007, and March 17, 2007. A March high temperature above 100°F for Furnace Creek has only happened 10 times.

For the California Data Exchange Center's (CDEC) network of temperature gages used in this report, 198 stations recorded a minimum temperature below freezing in March while one station reached or exceeded 100°F at least once during the month. Statewide extremes from the CDEC network of temperature gages are shown below. Also shown are the monthly average extremes from the CIMIS network. A table of regional average minimum, mean, and maximum temperatures from the CDEC stations is also shown at the end of the summary.

Precipitation in March was plentiful across most of the state. For the CDEC precipitation gages for March 2011, the largest amount of precipitation recorded was at Bowman in the Yuba/Bear River Basin with 29.33 inches. This is 314% of the average precipitation for this station for March. At the other end of the spectrum, Imperial Valley recorded no precipitation for the month. For the CIMIS network, Camino in El Dorado County topped the precipitation charts with 15.24 inches for the month and 11 stations recorded no precipitation. Some CIMIS gages may show large precipitation totals if the gages are not covered during irrigation activities so care should be given to review precipitation data used from this network. This is normally not an issue in the winter.

The 8-Station Index for northern California precipitation recorded 18.5 inches in March with 18 days showing precipitation. On average, 6.9 inches of precipitation is recorded for the 8-Station index in March. This was the third wettest March on record for the 8-Station Index exceeding the "Miracle March of 1991when 17.9 inches fell. In the Feather River watershed which is a subset of the area covered by the 8 station index, 10.1 inches of rain fell from March 18th through March 27th. This is 20% of the water year average for the 8 station index. Statewide, the average precipitation for March was 218% of the long-term average based on the California Data Exchange Center (CDEC) gages. Precipitation percentages by region from the CDEC gages are shown in a table at the end of this document.

Such prodigious rainfall also resulted in some impressive runoff for the State. On March 21st, monitor stage or flood stage was reached on rivers from the Eel to the San Diego. Tisdale, Colusa, and Freemont weirs on the Sacramento River started flowing moving water into the flood bypass system. Flows in several local streams and creeks exceeded their banks. For the month of March, Oroville Reservoir recorded over one million acre-feet of inflow. Annual average inflow to Oroville is 4.6 million acre-feet while the average March inflow is only 726 thousand acre-feet. Shasta Reservoir recorded 1.48 million acre-feet of inflow. The annual average inflow to Shasta Reservoir is 6.1 million acre-feet while the March average inflow is 922 thousand acre-feet.

CoCoRaHS Update

March 2011 continues California's third year with CoCoRaHS – the Community Collaborative Rain, Hail and Snow Network. This group uses citizen volunteers to record rain, hail and snow data. The users enter the data online at the CoCoRaHS web site. The web site provides the opportunity to see spatial detail of rain and snow patterns in participating states. Maps from March 20th and March 21st, 2011 are shown at the end of the document. As of the end of March 2011, California has 783 volunteers signed up spanning 53 of California's 58 counties. The county with the most volunteers at the end of March is Sonoma with 88 volunteers. For the month of March 10,957 reports were recorded for California. The largest daily rain total for CoCoRaHS- CA in March was in Ventura County with 6.50 inches recorded on 3/21/11. This coincides with the event that produced many monthly precipitation records for several locations in Southern California. Thirty-nine hail reports were recorded from sixteen counties. The largest reported hail stones were grape sized in Shasta County. Two hundred six snow reports were included with the precipitation reports with a 44 inch depth being the largest new snow total from Placer County on the 25h. The largest total snow depth reported was 99 inches reported at 2 sites with one in Placer County and one in Nevada County. Note that 99 inches is the largest number that the observer can enter into the database. In the notes section the Placer County observer notes that over 232 inches of snow depth was present on 3/31/2011. To join CoCoRaHS or find more information, please visit http://www.cocorahs.org.

Snowpack and Water Supply Conditions

As of the end of March, the snow pillow sensors show the statewide snowpack to be163% of average for the date and the April 1st average peak. The 48 inches of snow water equivalent is a sixteen inch increase from the beginning of March. The Northern Region (from the Trinity to the Feather and Truckee Basins) shows 50 inches of snow water equivalent which is 174% of average to date and the April 1st peak. The Central Region (the Yuba Basin to the Merced/Walker Basins) shows 50 inches of snow water equivalent which is 162% of average to date and the April 1st peak. The Southern Region (the San Joaquin Basin to the Kern Basin) shows 41 inches of snow water equivalent which is 155% of average to date and the April 1st peak. Water year 2011 has begun for the water supply index categories. Water year 2010 resulted in a below normal category for the Sacramento Basin and above normal category for the San Joaquin Basin for the Water Supply Index. The end-of-March Water Supply Index forecast for WY 2011 is wet for the Sacramento Basin and wet for the San Joaquin Basin. Water supply information for California can be found at http://cdec.water.ca.gov/water_supply.html. A historical listing of water year categories for both basins can be found at http://cdec.water.ca.gov/cgi-progs/iodir/WSIHIST.

Drought Monitor and Seasonal Outlook

The maps for California for March 1, 2011 and March 29, 2011 are shown below. The Drought Monitor maps can be found on the National Drought Mitigation Center's

(NDMC) website http://drought.unl.edu/dm/. These maps are largely a reflection of precipitation and soil moisture deficit estimates. As of the March 29th depiction, California is depicted as drought free. Maps are updated weekly.

The U.S. Seasonal Drought Outlook for April through June from NOAA depicts California continuing to be drought free. This forecast is based primarily on climatology and forecast models. Updates are provided twice per month. Maps and information can be found at http://www.cpc.noaa.gov/products/expert_assessment/seasonal_drought.html. The California Nevada River Forecast Center has begun producing some drought monitoring tools for California. These tools look at the frequency associated with precipitation deficits for the Northern California Eight Station Index and the San Joaquin Five Station Index. Another tool looks at the frequency of end-of-month storage for select reservoirs in California. The frequencies of the observations are related to the Drought Monitor's drought categories D0 through D4. These tools can be found at http://www.cnrfc.noaa.gov/climate.php. For March, the Eight Station Index is in drought free conditions for a 12-month and 24 month period. The Five Station Index is also drought free for both periods. All reservoirs have above average storage for this time of year.

ENSO Conditions and Long-Range Outlooks

The El Niño/Southern Oscillation (ENSO) is being classified as a fading La Niña pattern. Equatorial sea surface temperature anomalies for the tropical Pacific have been negative with values of -0.6°C in the Niño 3.4 at the end of March. The January through March 3-month running mean of the Ocean Niño Index (ONI) is -1.2. This is the eighth consecutive ONI value to fall below the -0.5 threshold. Five consecutive ONI values need to be below the threshold for conditions to be classified as a La Niña event. Most forecast models have the tropical sea surface temperatures moving to ENSO neutral conditions, but remaining cooler than average through the spring of 2011. More information can be found at the Climate Prediction Center's web site: http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/ Updates are posted weekly. The latest three month outlook (April through June) from NOAA indicates increased chances of above normal temperatures for the southeastern corner of the state and equal chances of above normal or below normal temperature for the rest of the state. For precipitation, equal chances of above or below normal conditions are forecast for the entire state. Outlook plots and discussions can be fount at http://www.wrcc.dri.edu/longrang/. General weather information of interest can be found at http://www.noaawatch.gov/. For anomaly information please see http://www.wrcc.dri.edu/anom/cal_anom.html.

Agricultural Data

March 2011 continued winter crop harvests, new crop development, and preparations for spring plantings. Winter wheat, barley and oats and alfalfa regrowth continued to show good growth with the rainfall. Weed control occurred in some fields and rice

fields began to be prepared for the upcoming season. Cotton, corn and bean fields were planted as field conditions allowed. The almond bloom completed in the Sacramento Valley while it continued in the San Joaquin Valley. Some hail damage was reported and irrigation was applied to limit the effects of freezing temperatures on the buds. Stone fruits bloomed amid concerns of mold and mildew due to the wet weather. Strawberries were showing good development while olive orchards underwent pruning. Preparations were being made for the upcoming walnut bloom. For citrus crops, mandarins, navel oranges, grapefruit and lemons were being harvested. Winter vegetables and greenhouse crops also continued to be harvested with good conditions reported. Tomato fields were planted while lettuce fields were prepared in the San Joaquin Valley. Range and pasture conditions continued to show good conditions with the heavy rains. Milk production was tempered by the cool wet conditions. For further crop information see http://www.nass.usda.gov/index.asp.

Other Climate Summaries

California Climate Tracker (new product of Western Region Climate Center)
Golden Gate Weather Service Climate Summary
NOAA Monthly State of the Climate Report

Statewide Extremes (CDEC)

High Temperature – 103°F (Buttercup, Colorado River Desert)
Low Temperature – -10°F (Tunnel Guard Station, Tulare)
High Precipitation – 29.33 inches (Bowman, Sacramento Basin)
Low Precipitation – 0.0 inches (Imperial Valley, Colorado River Desert)

Statewide Extremes (CIMIS)

High Average Maximum Temperature – 90.8 ^{0}F (Westmorland North, Imperial County)
Low Average Minimum Temperature – 23.4 ^{0}F (Big Bear Lake San Bernardino County)
High Precipitation – 15.24 inches (Camino, El Dorado County)*
Low Precipitation – 0 inches (11 stations)
*Sometimes irrigation water from sprinklers gets counted as precipitation if the gage is not covered.

Statewide Precipitation Statistics

Hydrologic Region	Region Weight	Basin Reporting			Stations Reporting			% of Historic Average	
		Basins	Mar	Oct-Mar	Stations	Mar	Oct-Mar	Mar	Oct-Mar
North Coast	0.27	5	5	5	17	14	12	229.5%	119%
SF Bay	0.03	2	2	2	6	5	5	269.3%	138%
Central Coast	0.06	3	3	3	11	9	8	255.1%	145%
South Coast	0.06	3	3	3	14	13	10	125.3%	148%
Sacramento River	0.26	5	5	5	41	37	34	258.0%	137%
San Joaquin River	0.12	6	6	6	24	23	23	234.0%	159%
Tulare Lake	0.07	5	5	5	28	27	27	179.0%	162%
North Lahontan	0.04	3	3	3	13	11	9	236.7%	151%
South Lahontan	0.06	3	3	3	15	10	10	133.4%	171%
Colorado River	0.03	1	1	1	6	5	5	18.7%	113%
Statewide Weighted Average	1	36	36	36	175	154	143	218.6%	140%

Statewide Mean Temperature Data by Hydrologic Region (degrees F)

Hydrologic Region	No. Stations	Minimum	Average	Maximum
North Coast	19	28.5	41.0	73.1
SF Bay	8	35.5	48.0	76.8
Central Coast	14	31.5	49.9	84.7
South Coast	47	33.5	53.0	86.9
Sacramento	68	24.3	40.0	75.7
San Joaquin	42	20.1	38.8	72.4
Tulare Lake	18	11.8	36.6	70.4
North Lahontan	27	11.3	31.9	64.8
South Lahontan	16	15.0	37.9	71.2
Colorado River Desert	8	37.6	62.9	93.3
Statewide Weighted Average	267	24.7	41.7	75.3

U.S. Drought Monitor

March 1, 2011
Valid 7 a.m. EST

California

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	99.94	0.06	0.00	0.00	0.00	0.00
Last Week (02/22/2011 map)	99.94	0.06	0.00	0.00	0.00	0.00
3 Months Ago (11/30/2010 map)	81.67	18.33	2.41	0.00	0.00	0.00
Start of Calendar Year (12/28/2010 map)	98.62	1.38	0.00	0.00	0.00	0.00
Start of Water Year (09/28/2010 map)	85.44	14.56	8.08	0.24	0.00	0.00
One Year Ago (02/23/2010 map)	64.59	35.41	10.72	4.28	0.00	0.00

Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://drought.unl.edu/dm

Released Thursday, March 3, 2011
L. Edwards, Western Regional Climate Center

U.S. Drought Monitor

March 29, 2011
Valid 7 a.m. EST

California

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	99.94	0.06	0.00	0.00	0.00	0.00
Last Week (03/22/2011 map)	96.87	3.13	0.00	0.00	0.00	0.00
3 Months Ago (12/28/2010 map)	98.62	1.38	0.00	0.00	0.00	0.00
Start of Calendar Year (12/28/2010 map)	98.62	1.38	0.00	0.00	0.00	0.00
Start of Water Year (09/28/2010 map)	85.44	14.56	8.08	0.24	0.00	0.00
One Year Ago (03/23/2010 map)	64.29	35.71	9.91	7.10	0.00	0.00

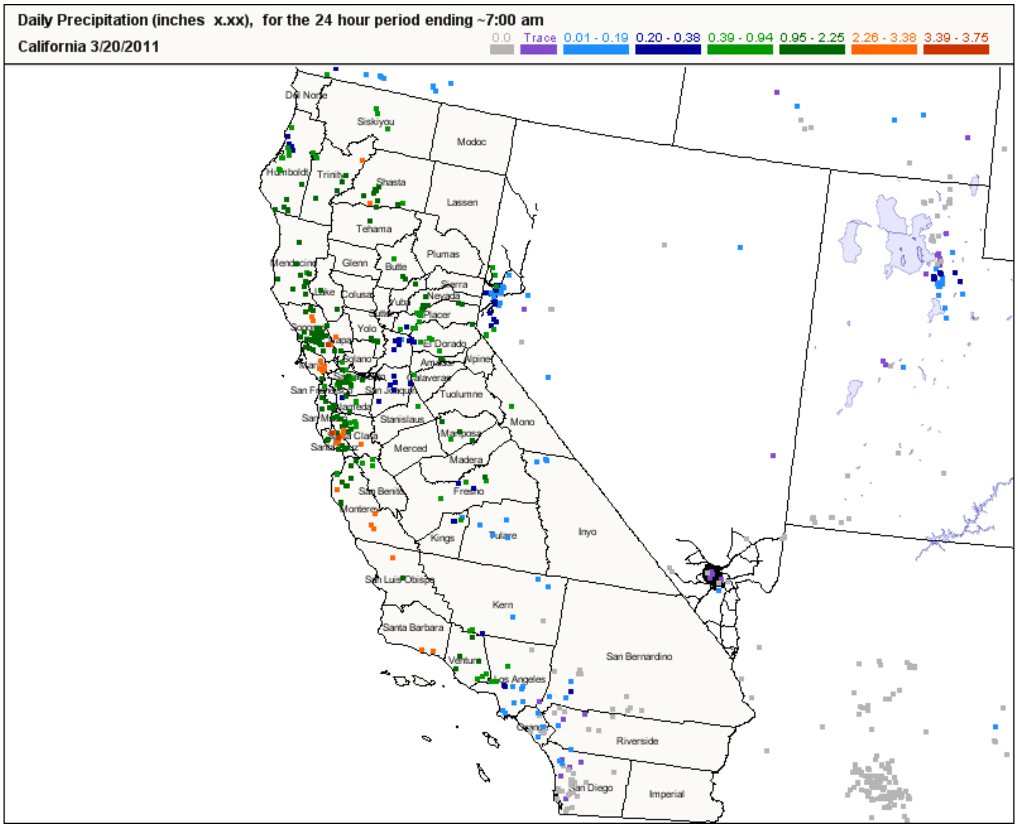
Intensity:

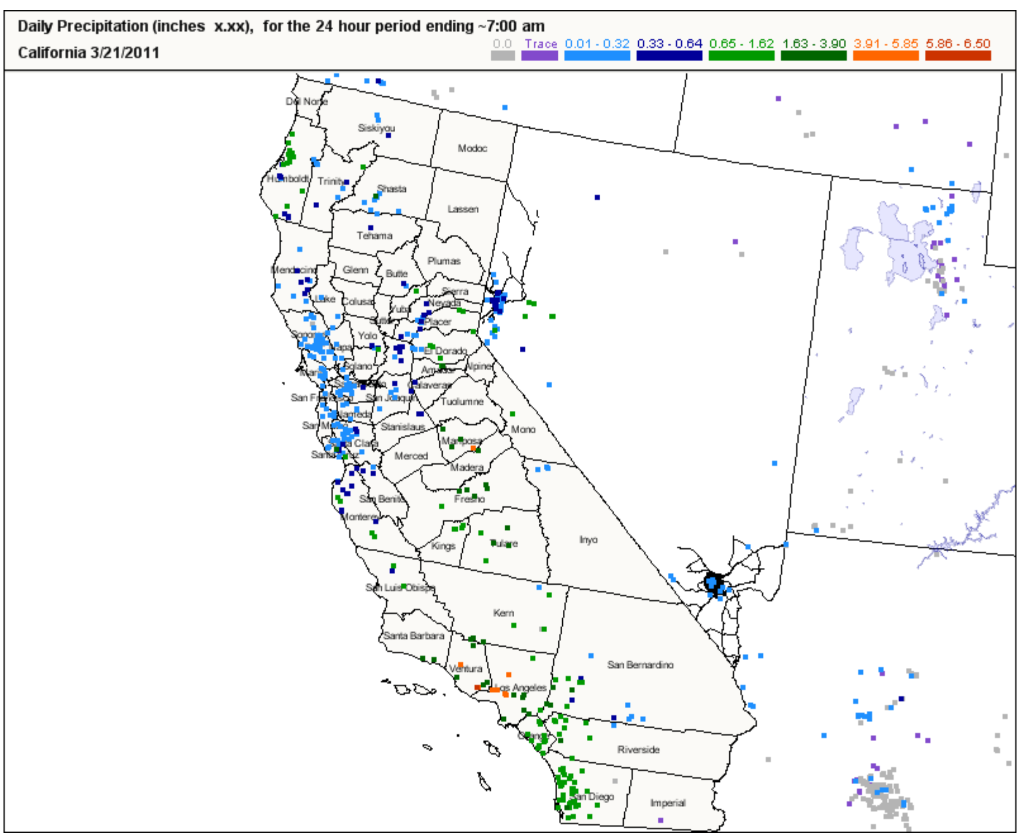
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://drought.unl.edu/dm

Released Thursday, March 31, 2011
Eric Luebehusen, United States Department of Agriculture


Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
California 3/20/2011
0.0
Trace
0.01 - 0.19
0.20 - 0.38
0.39 - 0.94
0.95 - 2.25
2.26 - 3.38
3.39 - 3.75


Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
California 3/21/2011
0.0
Trace
0.01 - 0.32
0.33 - 0.64
0.65 - 1.62
1.63 - 3.90
3.91 - 5.85
5.86 - 6.50